

Air Force's

Geo. Ref.

USAF Declass/Release Instructions On File

CONFIDENTIAL



DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON 25, D. C.

23 February 1956

AFOIN-1B

MEMORANDUM TO THE CHAIRMAN, AD HOC SUB-COMMITTEE ON INFORMATION PROCESSING

SUBJECT: (U) Use of Geographic Grid Coding in Machine Data Handling Systems

1. In the coding of information for retrieval from the Minicard Intelligence Data Handling System, a requirement exists for the addition of a system of geographic grid coding to permit the mechanical recovery of information required according to specific geographic location. Such a grid code would be used in addition to and not in lieu of the area portion of the CIA Intelligence Subject Code (ISC), which has already been adopted by most IAC agencies and which would still serve as the principle approach to area recovery. Through the addition of a geographic grid code, searches for information could be made by subject to geo-political area as now provided by the present ISC area code or to highly specific geographic location independent of political boundaries. Through the use of grid code total subject searches could be made on specific geo-political areas or specific grid squares. Such a capability would be an invaluable aid to the retrieval of information for the production and use of cartographic, aerial target and photo reconnaissance intelligence.

2. The application of such a grid code would be simple in operation. During the coding analysis operation, whenever geographic coordinates (latitudes and longitudes) are found in an intelligence document these would be converted to geographic grid code by use of a simple slide rule converter. Coding analysts could be trained in its use in about 30 minutes. The grid code thus derived would define a rectangle on the earth's surface in which the latitude and longitude coordinates would fall. A search on a given grid square would retrieve all data which had been specifically identified as falling within the area included in the grid square.

3. It is anticipated that grid codes would be applied only to information to which the reporting source has assigned latitude and longitude coordinates. To attempt to derive geographic coordinates from place names at the time of coding would, it is felt, lead to possible false locations in some instances due to inadequate identification, differences in spelling and duplication of place names. Geographic coordinates should be provided instead by the writer of the report.

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Memo for Ad-Hoc Sub-Comm, subj: (U) Use of Geographic Grid Coding in
Machine Data Handling Systems (Cont)

4. The Air Force has made a preliminary study of existing grid coding systems and has determined that the Geo-Ref grid system described in the attached papers would lend itself to community wide reciprocal coding.

5. Preliminary coordination concerning its possible adoption has been made between AFOIN, ACIC, AMS and the Naval Hydrographic office. No dissent was indicated at that time. It should be noted that approximately 75% of all Air Force published chart coverage now bears GeoRef grids.

6. A briefing on details of the GeoRef System will be arranged at the Committee's convenience.

7. It is not the intent of this proposal to in any way abridge standing joint agreements on use of grid codes for operational purposes. This proposal is concerned only with the mechanical retrieval of information for intelligence purposes.

8. In view of the foregoing, it is recommended that:

a. The Ad Hoc Sub-Committee on information processing undertake a study of the various existing grid coding system and select for common adoption and use, one which lends itself to machine data handling purposes.

b. Unless a better system is found, through AHIP study, it is recommended that the Geo-Ref system be adopted by the Intelligence Community for the purposes enumerated above.

Howard D. Kenzie
HOWARD D. KENZIE
Colonel, USAF
Air Force Member

2 Incls

1. Desc of GEOREF Grid Sys as Applied to Intell. Ref Coding
2. Same as Incl 1 (Practice Problems)

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DESCRIPTION OF THE GEO-REF GRID SYSTEM AS APPLIED
TO INTELLIGENCE REFERENCE CODING

The World GEOgraphic REFERENCE System (GEOREF) is an area reference device which embodies a number of unique advantages for the geographic classification of intelligence data.

Based upon a graticule of meridians of longitude and parallels of latitude, with a point of origin at the South Pole and the 180th meridian, GEOREF divides the entire earth's surface into 288 fifteen degree quadrangles. These fifteen degree quadrangles are designated by two letters. The first letter of the designation, "A" through "Z" (omitting "I" and "O") reflects distance (in fifteen degree increments) to the "Right" (or East) from the point of origin. Similarly the second letter designator, "A" through "M" (omitting "I") indicates distance "Up" (or North) from the origin. Thus, Washington, D.C. with approximate geographic coordinates of 38° N. and 77° W. (of Greenwich) would fall within the "GJ" fifteenth degree GEOREF quadrangle.

Each of the 288 fifteen degree quadrangles thus formed and designated areas, in turn, subdivided into 225 one degree quadrangles. With the southwest corner each fifteen degree quadrangle constituting an origin, the one degree quadrangles are designated by two additional letters. The first letter, "A" through "Q" (less "I" and "O") reflects the distance (in one degree increments) to the "Right" (East) from the point of origin. The second such letter, "A" through "Q" (less "I" and "O") indicates distance "Up" (North) from the origin. Washington (38° N. & 77° W.) may now be described as GJNJ.

JUL 1

By systematic assignment of four literal descriptors, the specific and unique identity of the (64,800) GEOREF one degree quadrangles covering the earth's surface is thus established. By the addition of numerical characters representing the 60 minutes contained in each degree and their decimal fractional parts it is readily possible to continue the systematic resubdivision as far as desired. Thus, (ficticiously) a quadrangle containing only the Washington Monument might become GJNJ 52645371 (or a quadrangle 1/100th of one minute, 1/100th of a nautical mile or approximately 60 ft. 7 in. on each side).

However, ACIC experience in the geographic area retrieval of intelligence data has projected the desireability of a recovery capability down to the ten minute quadrangle. In the case of Washington (GJNJ), by adding two digits, the ten minute quadrangle into which most of the District of Columbia and Arlington County falls, is established - GJNJ 55. The first digit represents the distance, in ten minute increments, from the southwest of GJNJ in the "Right" (East) direction while the second number reflects the "Up" (North) distance. The ten minute GEOREF description of Seoul becomes SJGH 53. Through the use of six descriptors, GEOREF has the capability of specifically identifying any one of the 2,332,800 ten minute quadrangles involved in world coverage.

Several characteristics of GEOREF as it applies to intelligence data retrieval, should be noted. No ambiguity exists within the system. The designators established for any GEOREF quadrangle, however, large or small, apply to that quadrangle only. Such is not the case with geographic coordinates, since direction descriptors are required to avoid a four-way

P-4

ambiguity if only the numerical values are given. From the GEOREF world a subdivision down to the smallest quadrangle, GEOREF follows the "Read-Right-Up" pattern which characterizes military grid systems. With GEOREF designators, the limits of the area referenced are explicit in the expression - WJ limits the reference to a 15° quadrangle, GJNJ designates a 1° quadrangle while GJNJ 55 delimits a 10 minute quadrangle. With GEOREF's "box-within-box" concept of successive subdivision, the retrieval of information on areas of varying size is simplified. Use in conjunction with officially accepted coordinates published in NIS Gazetteers, the GEOREF 10 minute quadrangle recovery imparts the ability to effect "urban area" retrieval in most cases - without having to "sort on" the town name.

Since GEOREF designators are determined as linear functions of the latitude and longitude parameters, it has been feasible to develop at least two relatively simple conversion devices. Both of these converters may be operated by unskilled personnel after only a few minutes training.

One line of Minicard code will accomodate the six descriptors required for GEOREF 10-minute coding, which is considered adequate for most intelligence reference purposes.

NOTE:

<u>Designators</u>	<u>Quadrangle</u>	<u>Nautical Miles</u>	<u>Statute Miles</u>	<u>Feet</u>
GJ	15 degree	900	1036.44	
GJNJ	1 degree	60	69.096	
GJNJ 55	10 minute	6	6.9096	36,481
GJNJ 5253	1 minute	1	1.1516	6080.2

NOTE: (Cont'd)

<u>Designators</u>	<u>Quadrangle</u>	<u>Nautical Miles</u>	<u>Statute Miles</u>	<u>Feet</u>
GJNJ 526537	1/10 minute	1/10		608.02
GJNJ 52645371	1/100 minute	1/100		60.802
GJNJ 5264353716	1/1000 minute	1/1000		6.0802

DESCRIPTION OF THE GEO-REF GRID SYSTEM AS APPLIED
TO INTELLIGENCE REFERENCE CODING
(Practice Problems)

MARK II

1. Given: Geographic coordinates $32^{\circ}00' S$ - $72^{\circ}00' E$.
2. To convert to GEOREF designators:
 - a. Set pointer arrow on dot to right of 72° .
 - b. Read 15° and 1° designators from windows labelled "East longitude" (i.e., "S" and "N").
 - c. Note designators on scratch pad, leaving space between the two S N.
 - d. Set pointer arrow on dot to right of 31° . The given longitude of $32^{\circ}00' S$, is considered as $31^{\circ}60' S$, in accordance with the note in lower right corner of the converter.
 - e. Read 15° and 1° designators from windows labelled "South latitude (i.e., "D" and "P").
 - f. Combine the values obtained in e (above) with those in c (above) to form the alphabetical portion of the GEOREF reading, "SDNP".
 - g. Apply the $00'$ of East longitude directly without conversion.
 - h. Convert the $60'$ of South latitude on the minute conversion scale, obtaining the value "00" (GEOREF minutes).
3. The complete GEOREF reading is SDNPO000.

Sheet 2

MARK II

1. Given: Geographic coordinates, $28^{\circ}53'N$ - $113^{\circ}36'W$.
2. To convert to GEOREF designators:
 - a. Set pointer arrow on dot to right of 113° .
 - b. Read 15° and 1° designators from "windows" labelled "West Longitude" (i.e., "E" and "G").
 - c. Note designators on scratch pad leaving space between the two:
E G.
 - d. Set pointer arrow on dot to right of 28° .
 - e. Read 15° and 1° designators from windows labelled "North latitude" (i.e., "H" and "P").
 - f. Combine the values obtained in e (above) with those in c (above) to form the alphabetical portion of the GEOREF reading: "EHGP".
 - g. Convert the $36'$ of West longitude on the minute conversion scale, obtained the value "24" (GEOREF minutes).
 - h. Apply the $07'$ of North latitude directly, without conversion
3. The complete GEOREF reading is EHGP2407

Jul 2.

MARK II

1. Given: Geographic coordinates $50^{\circ}28'N$ - $03^{\circ}54'E$.
2. To convert to GEOREF designators:
 - a. Set pointer arrow on dot to right of 8° .
 - b. Read 15° and 1° designators through windows labelled "East Longitude" (i.e., "N" and "J").
 - c. Note designators on scratch pad, leaving space between the two: N J.
 - d. Set pointer arrow on dot to right 50° .
 - e. Read 15° and 1° designators through windows labelled "North Latitude" (i.e., "K" and "F").
 - f. Combine the values obtained in e (above) with those in c (above) to form the alphabetical portion of the GEOREF reading NKJF.
 - g. Add minute values directly (no conversions required) in proper sequence, longitude first, to obtain the complete GEOREF expression.
3. The complete GEOREF reading is NKJF5428.

Line 2

DESCRIPTION OF THE GEO-REF GRID SYSTEM AS APPLIED
TO INTELLIGENCE REFERENCE CODING
(Practice Problems)

MARK III

1. Given: Geographic Coordinates: $77^{\circ}02'W$ - $38^{\circ}53'N$.
(Zero Milestone, Washington, D.C.)
2. To convert to GEOREF designators:
 - a. Set hairline of rider at "77" on scale B-1.
 - b. Adjust sliding scales until "38", on scale C-1 is in coincide with the hairline.
 - c. Read downward under hairline on all four scales (B-1, C-1, B-2, C-2) for the alphabetical GEOREF designators "GJNJ".
 - d. Convert the $02'$ in West longitude reading on scale "E", obtaining "58" as the GEOREF minute value.
 - e. Apply the North latitude minute value "53" directly.
 - f. Adding the numerical minute values to the alphabetical designators, the complete GEOREF reading is GJNJ 5853.

Part 2

MARK III

1. Given: Geographic Coordinates $72^{\circ}28' E$ - $48^{\circ}43' N$.
2. To convert to GEOREF designators:
 - a. Set hairline at "72" on scale A-1.
 - b. Adjust sliding scales until "48" on scale C-1 is in coincidence with hairline.
 - c. Read downward under hairline on all four scales (A-1, C-1, A-2 and C-2) for the alphabetical GEOREF designators "SKND".
 - d. Add the minute values directly, longitude first, and determine the complete reading to be "SKND 2834".

Line 2

MARK III

1. Given: Geographic Coordinates: $52^{\circ}48'W.$ - $03^{\circ}25'S.$
2. To convert to GEOREF designators:
 - a. Set hairline at "52" on scale B-1.
 - b. Adjust sliding scales until "3" on scale D-1 is under hairline
 - c. Read downward under hairline (B-1, D-1, B-2, and D-2) to obtain GEOREF designators in proper sequence.
 - d. Convert 48 minutes, and 25 minutes on scale "E" to obtain 12 and 35 GEOREF minutes, respectively.
 - e. Adding these numerical values to the alphabetical reference, the complete GEOREF reading is determined to be JFHM 1235.

Jul 2

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One line of Minicard code will accommodate the six descriptors required for GEOREF 10-minute coding, which is considered adequate for most intelligence reference purposes.

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DESCRIPTION OF THE GEO-REF GRID SYSTEM AS APPLIED
TO INTELLIGENCE REFERENCE CODING
(Practice Problems)

MARK II

1. Given: Geographic coordinates $32^{\circ}00' S$ - $72^{\circ}00' E$.
2. To convert to GEOREF designators:
 - a. Set pointer arrow on dot to right of 72° .
 - b. Read 15° and 1° designators from windows labelled "East longitude" (i.e., "S" and "N").
 - c. Note designators on scratch pad, leaving space between the two S N.
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 - e. Read 15° and 1° designators from windows labelled "South latitude (i.e., "D" and "P").
 - f. Combine the values obtained in e (above) with those in c (above) to form the alphabetical portion of the GEOREF reading, "SDNP".
 - g. Apply the $00'$ of East longitude directly without conversion.
 - h. Convert the $60'$ of South latitude on the minute conversion scale, obtaining the value "00" (GEOREF minutes).
3. The complete GEOREF reading is SDNP0000.

Sheet 2

MARK II

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E G.
 - d. Set pointer arrow on dot to right of 28° .
 - e. Read 15° and 1° designators from windows labelled "North latitude" (i.e., "H" and "P").
 - f. Combine the values obtained in e (above) with those in c (above) to form the alphabetical portion of the GEOREF reading: "EHGP".
 - g. Convert the $36'$ of West longitude on the minute conversion scale, obtained the value "24" (GEOREF minutes).
 - h. Apply the $07'$ of North latitude directly, without conversion
3. The complete GEOREF reading is EHGP2407

line 2

MARK II

1. Given: Geographic coordinates $50^{\circ}28'N$ - $03^{\circ}54'E$.
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 - a. Set pointer arrow on dot to right of 8° .
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 - f. Combine the values obtained in e (above) with those in c (above) to form the alphabetical portion of the GEOREF reading NKJF.
 - g. Add minute values directly (no conversions required) in proper sequence, longitude first, to obtain the complete GEOREF expression.
3. The complete GEOREF reading is NKJF5428.

Part 2

DESCRIPTION OF THE GEO-REF GRID SYSTEM AS APPLIED
TO INTELLIGENCE REFERENCE CODING
(Practice Problems)

MARK III

1. Given: Geographic Coordinates: $77^{\circ}02'W$ - $38^{\circ}53'N$.
(Zero Milestone, Washington, D.C.)
2. To convert to GEOREF designators:
 - a. Set hairline of rider at "77" on scale B-1.
 - b. Adjust sliding scales until "38", on scale C-1 is in coincide with the hairline.
 - c. Read downward under hairline on all four scales (B-1, C-1, B-2, C-2) for the alphabetical GEOREF designators "GJNJ".
 - d. Convert the 02' in West longitude reading on scale "E", obtaining "58" as the GEOREF minute value.
 - e. Apply the North latitude minute value "53" directly.
 - f. Adding the numerical minute values to the alphabetical designators, the complete GEOREF reading is GJNJ 5853.

Page 2

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Page 2

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Jul 2

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Cheney

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON 25, D. C.

23 February 1956

AFOTIN-1B

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However, ACIC experience in the geographic area retrieval of intelligence data has projected the desireability of a recovery capability down to the ten minute quadrangle. In the case of Washington (GJNJ), by adding two digits, the ten minute quadrangle into which most of the District of Columbia and Arlington County falls, is established - GJNJ 55. The first digit represents the distance, in ten minuta increments, from the southwest of GJNJ in the "Right" (East) direction while the second number reflects the "Up" (North) distance. The ten minute GEOREF description of Seoul becomes SJGH 53. Through the use of six descriptors, GEOREF has the capability of specifically identifying any one of the 2,332,800 ten Minute quadrangles involved in world coverage.

Several characteristics of GEOREF as it applies to intelligence data retrieval, should be noted. No ambiguity exists within the system. The designators established for any GEOREF quadrangle, however, large or small, apply to that quadrangle only. Such is not the case with geographic coordinates, since direction descriptors are required to avoid a four-way

ambiguity if only the numerical values are given. From the GEOREF world a subdivision down to the smallest quadrangle, GEOREF follows the "Read-Right-Up" pattern which characterizes military grid systems. With GEOREF designators, the limits of the area referenced are explicit in the expression - WJ limits the reference to a 15° quadrangle, GJNJ designates a 1° quadrangle while GJNJ 55 delimits a 10 minute quadrangle. With GEOREF's "box-within-box" concept of successive subdivision, the retrieval of information on areas of varying size is simplified. Use in conjunction with officially accepted coordinates published in NIS Gazetteers, the GEOREF 10 minute quadrangle recovery imparts the ability to effect "urban area" retrieval in most cases - without having to "sort on" the town name.

Since GEOREF designators are determined as linear functions of the latitude and longitude parameters, it has been feasible to develop at least two relatively simple conversion devices. Both of these converters may be operated by unskilled personnel after only a few minutes training.

One line of Minicard code will accommodate the six descriptors required for GEOREF 10-minute coding, which is considered adequate for most intelligence reference purposes.

NOTE:

<u>Designators</u>	<u>Quadrangle</u>	<u>Nautical Miles</u>	<u>Statute Miles</u>	<u>Feet</u>
GJ	15 degree	900	1036.44	
GJNJ	1 degree	60	69.096	
GJNJ 55	10 minute	6	6.9096	36,481
GJNJ 5253	1 minute	1	1.1516	6080.2

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NOTE: (Cont'd)

<u>Designators</u>	<u>Quadrangle</u>	<u>Nautical Miles</u>	<u>Statute Miles</u>	<u>Feet</u>
GJNJ 526537	1/10 minute	1/10		608.02
GJNJ 52645371	1/100 minute	1/100		60.802
GJNJ 5264353716	1/1000 minute	1/1000		6.0802

DESCRIPTION OF THE GEO-REF GRID SYSTEM AS APPLIED
TO INTELLIGENCE REFERENCE CODING
(Practice Problems)

MARK II

1. Given: Geographic coordinates $32^{\circ}00' S$ - $72^{\circ}00' E$.
2. To convert to GEOREF designators:
 - a. Set pointer arrow on dot to right of 72° .
 - b. Read 15° and 1° designators from windows labelled "East longitude" (i.e., "S" and "N").
 - c. Note designators on scratch pad, leaving space between the two S N.
 - d. Set pointer arrow on dot to right of 31° . The given longitude of $32^{\circ}00' S$, is considered as $31^{\circ}60' S$, in accordance with the note in lower right corner of the converter.
 - e. Read 15° and 1° designators from windows labelled "South latitude (i.e., "D" and "P").
 - f. Combine the values obtained in e (above) with those in c (above) to form the alphabetical portion of the GEOREF reading, "SDNP".
 - g. Apply the $00'$ of East longitude directly without conversion.
 - h. Convert the $60'$ of South latitude on the minute conversion scale, obtaining the value "00" (GEOREF minutes).
3. The complete GEOREF reading is SDNP0000.

Sheet 2

MARK II

1. Given: Geographic coordinates, $28^{\circ}53'N$ - $113^{\circ}36'W$.
2. To convert to GEOREF designators:
 - a. Set pointer arrow on dot to right of 113° .
 - b. Read 15° and 1° designators from "windows" labelled "West Longitude" (i.e., "E" and "G").
 - c. Note designators on scratch pad leaving space between the two:
E G.
 - d. Set pointer arrow on dot to right of 28° .
 - e. Read 15° and 1° designators from windows labelled "North latitude" (i.e., "H" and "P").
 - f. Combine the values obtained in e (above) with those in c (above) to form the alphabetical portion of the GEOREF reading: "EHGP".
 - g. Convert the $36'$ of West longitude on the minute conversion scale, obtained the value "24" (GEOREF minutes).
 - h. Apply the $07'$ of North latitude directly, without conversion
3. The complete GEOREF reading is EHGP2407

Sheet 2.

MARK II

1. Given: Geographic coordinates $50^{\circ}28'N$ - $03^{\circ}54'E$.
2. To convert to GEOREF designators:
 - a. Set pointer arrow on dot to right of 80° .
 - b. Read 15° and 1° designators through windows labelled "East Longitude" (i.e., "N" and "J").
 - c. Note designators on scratch pad, leaving space between the two: N J.
 - d. Set pointer arrow on dot to right 50° .
 - e. Read 15° and 1° designators through windows labelled "North Latitude" (i.e., "K" and "F").
 - f. Combine the values obtained in e (above) with those in c (above) to form the alphabetical portion of the GEOREF reading NKJF.
 - g. Add minute values directly (no conversions required) in proper sequence, longitude first, to obtain the complete GEOREF expression.
3. The complete GEOREF reading is NKJF5428.

Page 2

DESCRIPTION OF THE GEO-REF GRID SYSTEM AS APPLIED
TO INTELLIGENCE REFERENCE CODING
(Practice Problems)

MARK III

1. Given: Geographic Coordinates: $77^{\circ}02'W$ - $38^{\circ}53'N$.
(Zero Milestone, Washington, D.C.)
2. To convert to GEOREF designators:
 - a. Set hairline of rider at "77" on scale B-1.
 - b. Adjust sliding scales until "38", on scale C-1 is in coincide with the hairline.
 - c. Read downward under hairline on all four scales (B-1, C-1, B-2, C-2) for the alphabetical GEOREF designators "GJNJ".
 - d. Convert the $02'$ in West longitude reading on scale "E", obtaining "58" as the GEOREF minute value.
 - e. Apply the North latitude minute value "53" directly.
 - f. Adding the numerical minute values to the alphabetical designators, the complete GEOREF reading is GJNJ 5853.

line 2

MARK III

1. Given: Geographic Coordinates $72^{\circ}28' E$ - $48^{\circ}43' N$.
2. To convert to GEOREF designators:
 - a. Set hairline at "72" on scale A-1.
 - b. Adjust sliding scales until "48" on scale C-1 is in coincidence with hairline.
 - c. Read downward under hairline on all four scales (A-1, C-1, A-2 and C-2) for the alphabetical GEOREF designators "SKND".
 - d. Add the minute values directly, longitude first, and determine the complete reading to be "SKND 2834".

Page 2

MARK III

1. Given: Geographic Coordinates: $52^{\circ}48'W.$ - $03^{\circ}25'S.$
2. To convert to GEOREF designators:
 - a. Set hairline at "52" on scale B-1.
 - b. Adjust sliding scales until "3" on scale D-1 is under hairline
 - c. Read downward under hairline (B-1, D-1, E-2, and D-2) to obtain GEOREF designators in proper sequence.
 - d. Convert 48 minutes, and 25 minutes on scale "E" to obtain 12 and 35 GEOREF minutes, respectively.
 - e. Adding these numerical values to the alphabetical reference, the complete GEOREF reading is determined to be JFHM 1235.

Sheet 2